

unsatisfactory, the observer will accept censure, when properly given without resentment and will try to improve his work. The temperaments and dispositions of observers should be carefully studied by the section director so that correspondence may be tempered to the individual and thus tie him more closely to the service in a friendly bond and build up the esprit de corps. Flattery is not needed, only frank friendliness and appreciation. It seems to me that the thing of greatest value in the inspection of cooperative stations is not to determine whether instruments are properly exposed and taken care of, for that can largely be done by correspondence, but rather the few hours of personal and intimate contact during which the section director and the observer can come to know each other and thus lay the foundation for continued friendly relations more firmly. Thus each may come to a better understanding of the problems of the other. Such understanding will lead to better results in the work and to greater satisfaction for both the section director and the observer in carrying it on.

In this paper I do not attempt to eulogize cooperative observers. I fear that I am unable to do justice to those unselfish individuals who, day after day and year after year, prompted by a desire to serve their fellow man, faithfully and conscientiously give their time and effort without financial compensation, and often, doubtless, at great inconvenience to themselves, to secure a reliable climatological history of their respective localities. I hope they feel that they have adequate reward in the consciousness of being good and faithful workers. The service performed by these men or women is not confined to taking and recording observations. They have many other calls upon their time in this connection. Many of

them prepare weekly and monthly summaries of their data for the press. Occasionally one of them is called upon to take the records of his station into court. At all times, and particularly when unusual conditions prevail, he is subject to call from the people of his community for information as to temperature and precipitation. Also most of them prepare a weekly weather and crop report for the section center. This brings to me the thought that there is another group cooperating with the Weather Bureau that deserves commendation, namely, the weather and crop correspondents. A conscientious correspondent gives considerable time and thought to the preparation of his reports, and we have a few in South Dakota who make it their business to make long drives into the surrounding country to note crop conditions.

South Dakota has, perhaps, no observers who have served for such long periods as have a few observers in other sections, but she has many who have served long enough to be placed on a special honor roll. She has 18 observers who have served 20 or more years, 10 who have served more than 25 years, 9 who have served more than 30 years, 1 who has served 39 years, and one, Mr. D. G. Gallett, of Aberdeen, who has served 40 years. In making the above statement I have considered a family as one observer. Four of the above number fall into this class. Two sons, carrying on after the deaths of their fathers, and one widow after the death of her husband, have brought the total period of family service in each case to 33 years, and one son after the death of his father has brought the total period of family service to 39 years. These are records of which the makers of them can well be proud.

CONVENIENT METEOROLOGICAL RECORDS

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All business and professional activities require records, and in the light of experience these records should be in such form as readily to group themselves into classifications convenient for both comparison and summation.

Both in business and in our own professional work the time groups have logically arranged themselves into weekly and monthly periods. These two periods are not at present entirely commensurate; but, happily, it appears the time is not far distant when our international calendar conferences will make them so by adoption of the 4-week month, with 13 months to a calendar year.

In most of our work our records are arranged as nearly as practicable on the monthly basis and we customarily compute these in such time periods.

The last revision of our principal meteorological forms occurred about 28 years ago. At that time the committee handling the matter was somewhat divided on the size. The central office apparently adhered to the old size; the station representatives advocated one more conveniently slipped into the pocket, and especially convenient for use in court. With the present policy of taking the original records to court only when the certified compilations will not serve equally well, this necessity of convenience need not longer enter into the discussion. At that time, though compactness was urged, no change in size resulted, but the principal form, the present Form 1001, had added to it for station use Form 1014, to group daily data from a number of separate forms into a composite record on a single sheet for one day. For the study of several kinds of hourly data for a single period or not to exceed a single day, this is excellent; but for consideration of more exten-

sive periods than a day, these records on Form 1014 are too extended and require more compact recompilation.

In all studies and compilations the monthly series on a single page is the more useful. The necessity for grouping arose not from the difficulty of consulting two or more data on separate pages but from the defective system of ruling the time lines on forms or having to obtain data from blurred press copies on flimsy tissues, often illegible and widely scattered in the files.

In making all forms of scale the mechanic's rule, the draughtsman's scale, the engineer's transit circles, diverse ruling is employed to avoid error. There is no reason why, in making our records, we should not employ the same efficient devices. In truth, in some forms we do; in others we do not.

It is a physiological fact that the eye comprehends readily no more than three things. It focuses on a single thing, as for instance, a line and takes in with less distinction the ones on either side, while the next in order farther away from the central point of focus begins to fade out into the borders of obscurity. When guide lines are marked in groups of five by inclosure with boundary lines of distinguishing size or color, the eye can place itself with fair accuracy amongst the seven, selecting any single one. Increase the number between the distinguishing guide lines to more than five and selection of any single line becomes chance.

In all rulings of date lines and time lines for hourly periods suitable subdivision rulings should be used in every instance. It has become universal in all accounting systems. It should be so, too, in ruling our record

forms. If this had been done in the first place, and the use of press copy books abandoned, there would have been little need for form revision in 1904, and the records would have occupied but one-fifth the space and the printing bill would have been less.

Still another inconvenience has persisted from former years; we still turn some pages one way and some another. And, furthermore, the pages are not bound side by side, as has been the standard custom for centuries, but many of the pages are joined end to end in a position much as in ancient times papyrus was unrolled. Even papyri were improved and paged or columned so that one section was next to another side by side for more ready consultation.

In the present form of our main record one has difficulty in selecting the time lines; he must use one page for a desk with its bottom jammed against the body, often soiling it, while he consults the page above, or, if consulting the lower page, he flops the upper into his ink well. And then, to give variety, when he consults a third, he must twist the whole volume about, scattering the trappings from his desk.

All of this is illogical and unnecessary. The records will be just as accurate and more handy and usable if all pages are arranged upright, bound side by side, and ruled with that consideration for the limitations of selection by distinguishing division lines at intervals. For date lines the marking interval might be based on either weekly intervals or in groups of five, and the vertical columns should be in groups of no more than 6, which would make 4 equal groups for the 24 hours. These latter rulings would then conform as well with the present rulings of automatic register forms.

While rulings are under discussion, we might as well consider the serial records of observations on pages 2, 3, 10, and 11 of Form 1001. For upwards of 60 years we have been entering the amount, kind, and direction of clouds all jumbled together; and to-day, when considering analysis of conditions above the earth, these records are practically useless unless recomputed. Just at the present we do record the predominant direction of the so-called upper and lower cloud levels, but we then ignore all the others.

Prevailing direction may be of some value, as indicating somewhat around the normal tendency, but so much of our scientific progress is made through study of the abnormal—the unusual—and searching for the related causes.

Except for the magnitude of its obscurity, quantity of cloud is of no great importance. What is of more importance is that cloud movement shows the trend of winds otherwise beyond our reach.

So it seems, since the various classifications of clouds indicate that many air layers, each should be recorded so as not to obscure the individuality of these layers. The

present standard classification relates to about 9 levels and about 10 kinds of clouds if we separate cirrus from cirro-stratus clouds, which in nature probably are not so distinctly separated in movement. Nevertheless, for space taken in recording kind, direction, and for an unused blank there is found ample place to record separately each individual classification with its direction, as shown in a sample page of Form 1001 appended herewith.

Then, as well, we have need for the relative frequency from every direction. When each is in its separate column for classification and record of direction, it is then very easy to record the totals of the several directions, making summary of a complete record.

As to fog. Fog is perhaps of the same texture as stratus, and in an observation should not be ignored. On the other hand, it is believed no one ever heard of fog progressing against or across a wind. It always moves with it, and to record its direction is only to duplicate that made in another place by the wind vane. To count its surface direction amongst those of the lower clouds is only to vitiate the record we are making of winds above the earth. Its direction is of no importance.

Fog with haze and smoke, whether light or dense, may logically be recorded with state of weather at observation times; but from a consideration of its effect on both marine and aerial navigation, it should as well be recorded so as to show the period of continuance, and at no infrequent intervals the effect on visibility according to some standard scale. This would be a far more valuable record, both for current report and for future consideration from the summary of longer records. These effects on visibility are entirely worthy of a separate page for records of these elements. This record may well be developed from the experience of effects in our reporting for obstruction to navigation.

Permit me again to emphasize the necessity for arranging our record pages in logical position, with none upside down, crosswise or arranged in two-storied effect. Let's bind our books as the experience of the whole world has found most practicable since the inception of printing.

And, lastly, let us adhere to reasonable uniformity in our compilations. Let us not summarize, say, days of dense and light fogs one way in Form 1001, then another way in the means book. If it is necessary in one place to count as a day of light fog no day with dense, it should be uniform in both records. Neither should a day of snowfall as recorded in the summary of Form 1001 be one with 0.01 inch of melted snow and in the means book be one with 0.1 (one-tenth) inch unmelted, as makes the heading on page 29 of the latter. There may be other occasions of inconsistency that some of you recall. Let us eliminate them amongst ourselves before we betray these inconsistencies to the public, who are in increasing numbers consulting our compiled records.

TREE RINGS AND WHEAT YIELDS IN SOUTHERN SASKATCHEWAN

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This is the record of a study of radial tree growth at two points in southern Saskatchewan. The method followed is that set out by Dr. A. E. Douglass. A relationship is found between tree growth and wheat yields in southern Saskatchewan. Since crop records in this district go back only to 1898 and meteorological records go back only to 1883, the tree-ring chart, which goes back to 1763, is valuable in studying weather cycles which affect crop yields.

Most of southern Saskatchewan is a flat prairie with no trees. There are trees, however, in the eastern part and on Wood Mountain and the Cypress Hills in the west; but most of the old trees have been cut, and stumps rot so quickly that they can not be used for counting tree rings. There are also scattered clumps of trees near rivers and swamps. Trees from two such localities were studied. Eight cross sections of ash and one old elm were collected at the Trossachs grove 20 miles west of Weyburn in 1931.